COLSF 14.1 V1

INDEPENDENT REVIEW OF COLBERT LANDFILL SITE CLEANUP - PART I

SUMMARY SHEET: REVIEW OF THE PHASE I PILOT TREATMENT STUDY

Cascade Earth Sciences, Ltd. (CES) was retained by the Colbert Landfill Contaminate Area Committee (CLCAC), to provide independent technical assistance to review, analyze, and interpret documents produced from phases of remedial actions taken at the Colbert Landfill near Spokane, Washington. Because of past dumping practices at the Landfill, nearby domestic wells indicated the presence of certain contaminants, primarily six organic solvents, in the groundwater sufficient in quantity to warrant remedial action. Further investigation and studies were done to determine the nature and extent of the contamination, and to evaluate potential remedies. Data gathered from these investigations provided the basis for selection of the type of remedial action. Landau Associates, Inc. is the contractor responsible for the installation of the extraction and stripping system. This pilot study and system is the basis of their "Phase I" report.

The purpose of this review is twofold. The first section explains the groundwater extraction and stripping system installed during the pilot study. The second section compares results of the Phase I pilot study with what was anticipated in the design of the pilot treatment system.

Cleanup Methods

A pump and treat method of cleanup was chosen to extract contaminated groundwater. Wells are to be drilled in three strategic areas around the Landfill, and the groundwater transported through a treatment system. The treatment system will consist of an air stripping system that uses air to remove the volatile organic contaminants (chlorinated solvents) from the groundwater and then discharge the treated water via pipeline into the Little Spokane River. Contaminants that are removed from the water will be released from the system into the atmosphere. This treatment system is a widely accepted method of treating water contaminated with constituents like those at the Colbert Landfill.

Pilot Treatment Study

A pilot study was conducted using groundwater extraction wells and treatment systems as part of Phase I activities. Four pilot wells were installed for aquifer tests to determine critical hydrogeologic parameters. They also served as source wells for the treatment system to evaluate the effectiveness of the air stripping method prior to final design (Phase II). Trial runs of a pilot treatment system were conducted to test the effectiveness of the air stripping system.

Continued on Back

Review and Comments

The pilot study indicates the system will adequately clean groundwater to acceptable levels, however, some problems were encountered. Because of groundwater hardness, fouling of the system (by a build up of scale) occurred at times and required modifications to the system. Also, fouling of extractions wells (again, a build up of scale) caused automatic shutdown of the system. After adjustments were made, the tests were completed according to plans. The final design of the system will require specific modifications for proper operation during actual cleanup operations.

Since air stripping is designed to transfer contaminants from groundwater to the atmosphere, local air quality may become an issue. As designed, the air stripping system meets current air quality regulations, however, as these regulations become more stringent additional treatment measures may have to be considered. This was not addressed in the Landau Associates' reports.

Conclusions

Overall, Landau Associates' approach in the design and evaluation of the treatment system appears to have been well-directed in their pilot study. Design refinement for the final design (Phase II) of the treatment system can most likely be accomplished using the information Landau Associates gathered during the pilot study.

The problem of potential chemical fouling (scale build up) of the treatment system was not adequately resolved in Phase I. Phase II design should have adequate provisions for preventing chemical fouling to insure proper long-term operation of the treatment system.

INDEPENDENT REVIEW OF COLBERT LANDFILL SITE CLEANUP - PART 2

SUMMARY SHEET: REVIEW OF DATA COLLECTION METHODS, PROTOCOLS AND QUALITY ASSURANCE/QUALITY CONTROL (QA/QC) OF PHASE II ACTIVITIES

The County and its engineering consultant are currently implementing Phase II of the Remedial Design/Remedial Action (RD/RA) for the Colbert Landfill site. As part of the requirements for the Consent Decree, Spokane County and KeyTronic Corporation must provide workplans concerning data collection procedures, field and laboratory protocols, and quality assurance/quality control (QA/QC) to the Washington Department of Ecology (WDOE) and U.S. Environmental Protection Agency (EPA) for their review and approval. During Phase II of the project three major activities will be occurring: 1) extraction wells will be installed to intercept and collect contaminated groundwater; 2) treatment facilities will be constructed to treat the groundwater; and 3) monitoring wells will be installed to assess the performance of the treatment system. In addition, the Domestic Well Management Program will continue to be carried out by the County.

The purpose of this review is to explain the methods and procedures (protocols) used to collect data for describing, characterizing and monitoring the Colbert Landfill site and activities. Quality assurance/quality control procedures are critical to making sure good, useable data is collected. Overall, QA/QC plans were well done and thorough. The following discussion describes the methods and procedures used and some items that warrant further review.

Methods and Protocols

The *extraction well workplan* explains the development of a system to: 1) prevent the spread of contaminated groundwater downgradient of the interception system; 2) provide source control near the landfill; and 3) minimize further degradation of the groundwater resources.

The extraction system was designed using computer models to simulate groundwater flow, predict capture zones, and estimate contaminant concentrations and movement. Considerable expertise is required to use this computer model with confidence that the results will accurately predict the success of the extraction system. This is largely due to the assumptions that must be made to simplify complex earth systems for the computer model. As long as the limitations are well understood, computer modeling is a valuable tool for designing remediation systems.

Continued on Back

Assumptions and their specific limitations include:

1) Simplifying the groundwater system, to focus primarily on two aquifers (the Upper and Lower Sand/Gravel Aquifers), and to place less importance on the other less permeable zones. This simplification may underestimate the time required to adequately restore aquifers in the vicinity of the site to acceptable drinking water standards.

2) The pumping test data were evaluated using assumptions which may overestimate the critical values of hydraulic conductivity (the rate that water flows through the aquifer). This has the effect of overestimating groundwater flow which could make capture zone analysis inaccurate.

3) Hydrogeology east of the landfill is complex and has not been defined well enough to implement a remedial action plan in this portion of the site. A plan has been proposed to control the source of the contamination (the Landfill) to reduce the potential for further contamination.

The extraction wells on the South Interception System will fully penetrate the Upper Sand/Gravel Aquifer and are designed to remove contaminants from the entire saturated portion of the aquifer. The extraction wells in the West Interception and East Extraction System will extract water from the central portion of the Lower Sand/Gravel Aquifer to maximize the amount of water that can be treated. However, these extraction wells may not be effective at remediating the lower portion of this aquifer, as they do not penetrate the entire thickness of the aquifer.

The *groundwater monitoring plan* explains how the performance of extraction systems will be evaluated and monitors the leading edge of the plume as required in the Consent Decree. Monitoring wells are proposed for both South and West Interception Systems and include downgradient and crossgradient locations. The East Extraction System is not being monitored because its purpose is only to provide source control.

Several issues were not addressed in the groundwater monitoring plan. These include: 1) the placement (location and depth) of additional monitoring wells south of the South Interception System; 2) monitoring well design practices; 3) additional groundwater investigation east of the landfill; and 4) use of water wells to assist in monitoring system performance.

Well development is performed on wells to restore the aquifer to its natural condition and "set up" the filter pack (sand or gravel) which in turn provides better samples. The air-lift method of development is not recommended because the volatile constituents could evaporate and be lost from the sample. Well development should include monitoring physical parameters, including water level, temperature, pH, and electrical conductivity.

SUMMARY SHEET: REVIEW OF DATA COLLECTION METHODS, PROTOCOLS AND QUALITY ASSURANCE/QUALITY CONTROL (QA/QC) OF PHASE II ACTIVITIES

The procedures to dispose of drill cuttings (soil from the boreholes) and purge water from the wells needs to be reviewed. Current disposal plans include putting these wastes back

into the landfill. However, if test results conclude these wastes are contaminated, they should be disposed of properly, according to current WDOE regulation, and not be put into the landfill.

Monitoring wells and domestic water wells are being sampled in the vicinity of the landfill. The sampling plans for these wells lack rationale for using different types of pumps at different well locations, determining which wells should be selected for monitoring, and how to compare results from wells that obtain water from different locations and depths within an aquifer.

Domestic Well Sampling Plan

The domestic well sampling plan provides the necessary quality assurance (QA) and criteria for evaluating the drinking water quality of the aquifer being monitored. Some of these criteria may require further clarification. A second objective of the domestic well sampling should be to integrate these results with the monitoring well data from the remedial action. An evaluation of available data on the water wells should be reviewed to determine which wells should be included in regular groundwater monitoring events at the site.

General Comments

Phase I monitoring and pilot extraction wells were installed in 1989 and 1990. Wells installed prior to Phase I were constructed with well designs that are not currently acceptable and may be acting as conduits by allowing contaminated groundwater to flow into deeper aquifers. An evaluation of these wells to determine if any should be abandoned is warranted.

Quality Assurance/Quality Control Plan

The overall objectives of the QA/QC plan are to ensure that the data collected is comparable, accurate, and precise. One field audit and one laboratory audit have been performed to point out where the QA/QC plan was not being followed. Even though the procedures were modified or corrected, no audits have been performed since that time. A data validation report was developed for soil, groundwater, and treatability samples, following the completion of Phase I to determine if the QA/QC objectives were being met. Some of the results could not be validated and should not be used in evaluating the site.

INDEPENDENT REVIEW OF COLBERT LANDFILL SITE CLEANUP - PART 3

SUMMARY SHEET: ASSESSMENT OF THE EXTRACTION, TREATMENT, AND DISCHARGE SYSTEM, COLBERT LANDFILL

The groundwater beneath the Colbert Landfill site is located in a complex system of aquifers and geologic formations. This presents numerous challenges to scientists and engineers who want to design and execute a system to treat and control the groundwater contamination. Spokane County, KeyTronic Corp. and their engineering consultants have conducted an extensive investigation to characterize the Colbert Landfill site and the extent of the groundwater pollution it has produced. A groundwater extraction, treatment, and discharge system has been designed based on the study of these aquifers and is currently being installed.

Cascade Earth Sciences, Ltd. has reviewed Landau Associates' reports covering the design and implementation of the remedial action for groundwater contamination. Overall, these reports are thorough and have met the stipulations of the consent decree scope of work with no obvious errors or omissions. However, we have several areas of concern that are not addressed in these reports.

Understanding of the Groundwater System

As stated, the Colbert Landfill is located in a hydrogeologically complex area consisting of two primary (most permeable to water) aquifers (the Upper and Lower Sand/Gravel aquifers) where most water wells are installed, and secondary aquifers (less permeable to water) layered below and around the primary aquifers. The remedial action plan is to extract and treat groundwater from the two primary aquifers, however, contamination is known to exist in some of the secondary aquifers as well. The relationship between these two types of aquifers was not well enough explained in Landau Associates's report to justify not treating the secondary aquifers. The primary and secondary aquifers may be interconnected to each other, i.e., the contamination in the secondary aquifers could be polluting the treated primary aquifers now, or when the aquifers are pumped. Additionally, there was no discussion of the long-term effects that pumping of the primary aquifers would have on the local water supply wells.

The domestic well sampling program has assisted in monitoring well water for public health, however, Landau Associates did not rely on this information in designing remedial actions for the project. Water well data has been used occasionally, but not in a consistent manner. A thorough evaluation of the water wells in the affected area may provide data needed to improve the understanding of the subsurface geology, groundwater flow conditions and groundwater chemistry.

Continued on Back

The Colbert Landfill site has been investigated for approximately ten years, yet the reports we studied lacked comprehensive summaries of seasonal water level fluctuations and their relation to the Little Spokane River, groundwater quality in the aquifers, and changes in water levels due to pumping. Fluctuations in groundwater levels and groundwater quality will impact the efficiency of the extraction wells and should be studied.

Based on the available groundwater data, the contaminant plume may have migrated beyond the South Interception System's ability to capture and treat it. Similarly, wells and springs west of the Landfill, again outside the capture zone, have detectable concentrations of contaminants.

Comments and Discussions

In general, the hydrogeology and contamination in the Lower Sand/Gravel Aquifer is not well defined. The impact of the Lacustrine Aquitard (a secondary aquifer) is not well described. The West Interception System is designed to extract groundwater from the central portion of the Lower Sand/Gravel Aquifer, but it is unclear how contamination deeper in this aquifer will be captured using the current system. In addition, two extraction wells proposed to be installed in the Lower Sand/Gravel Aquifer in the final extraction well workplan will not be installed. Therefore the capture area may be reduced and contamination in this aquifer may not be removed.

Conclusions

The groundwater treatment system, as designed, should treat the groundwater as specified in the Consent Decree. The air stripping treatment system (a well proven technology) appears to be well designed and should function properly. However, this remedial action plan only addresses cleanup of the primary aquifers. Information provided in reports since the issuance of the Consent Decree indicates that this system, although it is designed as specified, will not clean up all the contaminated groundwater. It should serve, however, to keep contaminants from moving farther off site.